

CLAIMS

What is claimed is:

1. A communication network system comprising:
 - a resource managing unit for managing statuses of node resources in a network and statuses of link resources in said network,
 - a node function location controlling unit for relocating functions of functional nodes and data used for the functions in said network into an optimum condition, in accordance with said statuses of node resources which are managed by said resource managing unit, in response to an instruction of relocation,
 - a path structure controlling unit for restructuring a structure of paths in said network into an optimum condition, in accordance with said statuses of link resources which are managed by said resource managing unit, in response to an instruction of restructuring, and
 - an adaptive control determining unit for determining whether it is necessary to transmit said instruction of relocation to said node function location controlling unit or to transmit said instruction of restructuring to said path structure controlling unit on the basis of said statuses of node resources and said statuses of link resources which are managed by said resource managing unit, and transmitting said instruction of relocation when the transmission of said instruction of relocation is determined to be necessary or transmitting said instruction of restructuring when the transmission of said instruction of restructuring is determined to be necessary.
2. A communication network system according to Claim 1, further comprising:
 - service controlling devices each of which is one of said functional nodes and is capable of changing its own functions and data used for the functions, and comprises resources for providing communication services or data transfer services,

data transferring devices each of which is one of said functional nodes and is capable of changing its own functions, data used for the functions and connection statuses of paths for data communications, and comprises resources for providing communication services or data transfer services, and

a network structure controlling device which is connected to said service controlling devices and to said data transferring devices,

wherein, said network structure controlling device comprises said resource managing unit, said node function location controlling unit, said path structure controlling unit and said adaptive control determining unit.

3. A communication network system according to Claim 1, further comprising:

service controlling devices each of which is one of said functional nodes and is capable of changing its own functions and data used for the functions, and comprises resources for providing communication services or data transfer services,

data transferring devices each of which is one of said functional nodes and is capable of changing its own functions, data used for the functions and connection statuses of paths for data communications, and comprises resources for providing communication services or data transfer services,

network structure controlling devices which are distributed in said network, each of which comprises said node function location controlling unit, said path structure controlling unit and said adaptive control determining unit, and

a lock controlling unit for controlling locks of resources, when each of the resources should be controlled by only one of said network structure controlling devices to achieve the relocation or the restructuring, for avoiding each of the resources being controlled by more than one of said network structure controlling devices.

4. A network structure controlling device comprising:

a node function location controlling unit for relocating functions of functional nodes and data used for the functions in a network into an optimum condition, in accordance with statuses of node resources in said network, in response to an instruction of relocation,

a path structure controlling unit for restructuring a structure of paths in said network into an optimum condition, in accordance with statuses of link resources in said network, in response to an instruction of restructuring, and

an adaptive control determining unit for determining whether it is necessary to transmit said instruction of relocation to said node function location controlling unit or to transmit said instruction of restructuring to said path structure controlling unit on the basis of said statuses of node resources and said statuses of link resources in said network, and transmitting said instruction of relocation when the transmission of said instruction of relocation is determined to be necessary or transmitting said instruction of restructuring when the transmission of said instruction of restructuring is determined to be necessary.

5. A network structure controlling device according to Claim 4, wherein:

said adaptive control determining unit makes the determination when said adaptive control determining unit receives a request for an adaptive control of said node resources or said link resources from an external device.

6. A network structure controlling device according to Claim 4, further comprising:

a resource status collecting unit for collecting data on said statuses of node resources and data on said statuses of link resources in said network through said network, and

a resource managing unit for storing said data on said statuses of node resources and said data on said statuses of link resources which are collected by said resource status collecting unit.

7. A network structure controlling device according to Claim 4, further comprising:

a lock control requesting unit which transmits, when said instruction of relocation or said instruction of restructuring is transmitted and a certain resource is controlled by said network structure controlling device, a request for a lock control for avoiding said certain resource being controlled by another network structure controlling device, to a resource managing device for managing resources in said network.

8. A network structure controlling device according to any one of Claims 4 to 7, wherein:

said node function location controlling unit makes an optimum plan of said relocation and said path structure controlling unit makes an optimum plan of said restructuring by exchanging with each other data on a draft plan of said relocation and data on a draft plan of said restructuring.

9. A network resource status managing device comprising:

a resource status collecting unit for collecting data on statuses of node resources and data on statuses of link resources in a network through said network,

a network resource status storing unit for storing said data on statuses of node resources and said data on statuses of link resources which are collected by said resource status collecting unit, and

a lock controlling unit for controlling a lock of a certain resource, when said certain resource is controlled by a certain network structure controlling device to achieve a relocation of functions of nodes and data used for the functions in said network or to achieve a restructuring of a structure of paths in said network, for avoiding said certain resource being controlled by another network structure controlling device, in response to a request for a lock control from said certain network structure controlling device.

10. An adaptive control method comprising:

a node resource status monitoring step for a service controlling device and a data transferring device, which are included in a communication network system, to monitor statuses of node resources, which are resources for providing communication services or data transfer services, and to transmit data indicating said statuses of node resources,

a link resource status monitoring step for said data transferring device to monitor statuses of link resources, which are resources for providing data transfer services, and to transmit data indicating said statuses of link resources,

a network resource status collecting step for a network resource status managing device in said communication network system to receive and store said data indicating said statuses of node resources transmitted in said node resource status monitoring step and to receive and store said data indicating said statuses of link resources transmitted in said link resource status monitoring step,

an adaptive control determining step for a network structure controlling device in said communication network system to determine whether it is necessary to relocate functions and data for the functions of said service controlling device or of said data transferring device, or to determine whether it is necessary to restructure paths connected to said data transferring device, on the basis of data indicating said statuses of node resources and data indicating said statuses of link resources which are stored in said network resource status managing device, or in accordance with a request for an adaptive control of said node resources or said link resources from an external device,

a planning step where

said network structure controlling device makes a plan of relocation of the functions and the data for the functions so that said node resources and said link resources can be used in an optimum condition, and transmits an instruction to instruct said relocation of the functions and the data for the functions to said service controlling device or to said data transferring device, when it is determined

to be necessary to relocate the functions and the data for the functions in said adaptive control determining step,

or, said network structure controlling device makes a plan of restructuring of the paths so that said node resources and said link resources can be used in an optimum condition, and transmits an instruction to instruct said restructuring of the paths to said service controlling device or to said data transferring device, when it is determined to be necessary to restructure the paths in said adaptive control determining step, and

an optimizing step where

said service controlling device or said data transferring device changes its functions and data for the functions in accordance with said instruction to instruct said relocation of the functions and the data for the functions,

or, said data transferring device changes its paths in accordance with said instruction to instruct said restructuring of the paths.

11. An adaptive control method according to Claim 10, wherein:
in said planning step,

said network structure controlling device further transmits, to said network resource status managing device, a request for a lock control for avoiding said node resources and said link resources, which are controlled by said network structure controlling device after the relocation, being controlled by another network structure controlling device, when it is determined to be necessary to relocate the functions and the data for the functions in said adaptive control determining step,

or, said network structure controlling device further transmits, to said network resource status managing device, a request for a lock control for avoiding said node resources and said link resources, which are controlled by said network structure controlling device after the restructuring, being controlled by another network structure controlling device, when it is determined to be necessary to restructure the paths in said adaptive control determining step,

and said adaptive control method further comprises

a lock controlling step for said network resource status managing device to receive the request for a lock control which is transmitted in said planning step, and to control locks of said node resources and said link resources in accordance with the request for a lock control.

12. An adaptive control method according to Claim 11, wherein:
in said planning step,

said network structure controlling device makes an optimum plan of relocation of the functions and the data for the functions or an optimum plan of restructuring of the paths, on the basis of data on a draft plan of relocation of the functions and the data for the functions and data on a draft plan of restructuring of the paths